Biology 4605/7220 Name _____Key_____
Exam #1b 4 October 2005

1. R.D. Budd (1989, *American Journal of Drug and Alcohol Abuse* 15: 375-382) reported cocaine levels (microgram/ml) in 70 victims of violent death, in three categories.

Homicide	Accident	Suicide	
50	12	8	n
1.387	1.511	1.094	mean
1.319	2.175	1.002	stdev
0.05	0.05	0.05	alpha
1.013	0.129	0.256	lower limit
1.762	2.892	1.932	upper limit

Compute the confidence interval, defined as CI = Upper limit - Lower limit
for accidents __2.892−0.129 = 2.763__[1]

If the alpha for homicides decreases does the CI increase or decrease ? __increase__[1]

2. Mendel (1865) as reprinted in *Experiments in Plant Hybridization*, Harvard University Press (1933) reported the frequency of yellow and green pea seeds in a breeding experiment.

	Yellow	Green
Observed in sample	25	11
Expected in population	27	9

If the probability of a seed being yellow is p, then the odds in favour of a yellow seed are defined as Odds = p/q where q = 1 − p.
Read the expression (Odds = p/q : 1) as "odds are ____ to 1."

The odds ratio, for a sample relative to a population, is defined as the odds for the sample, divided by the odds for the population.

What is the probability that a seed is yellow, in the sample of 36 seeds ? p = _0.694_[1]

What were the odds of obtain a yellow seed in the sample ?Odds = __25/11=2.27:1__[1]

What is the expected (population) probability of a yellow seed ? p = _27/36=0.75_[1]

What are the expected odds of obtaining yellow seeds ? Odds = _27/9=3:1__[1]

What is the odds ratio, for the sample relative to
the population ? OR = __2.27/3=0.76__[1]

3a. Complete the following computations. [2]

$(10\ km)^{1.2}$ = $10^{1.2}\ km^{1.2} = 15.85\ km^{1.2}$

R = (1000 kg)/kg $\log_{10}(R)$ = $\log_{10} 10^3 = 3$

3b. Convert 15 kilometres travelled in 24 hours to speed in metre/second [1]

$$\frac{15km}{24hr}\frac{1000m}{1km}\frac{1hr}{60\,\text{min}}\frac{1\,\text{min}}{60\,\text{sec}} = 0.1736\,m/\text{sec}$$

4. Hypothesis testing is carried out with frequency distributions, either observed or theoretical.

What is the principal advantage of using an observed distribution ? [1]

No assumptions

What is the principal disadvantage (or cost) of using an observed distribution ? [1]

It takes far longer to obtain a p-value from an observed distribution than to obtain a p-value from a theoretical distribution

What is the principal advantage of using a theoretical distribution ? [1]

It takes little time to compute a p-value

5. In the blank spaces below list the 5 parts of a well defined biological quantity then give a five-part definition of human eyeblink rate. [5]
The numerical values you list must be biologically reasonable. If you don't have a watch, you can count seconds by repeating to yourself 1 monkey, 2 monkey, 3 monkey .....

Name	Symbol	Procedural Statement	Values	Units
Eyeblink rate			1/min to 60/min	

6. Type I error is a potential problem when rejecting the null (chance) hypothesis, while Type II error is a potential problem when accepting the null hypothesis. Circle either I or II to indicate the potential problem with each of the following decisions. [4]

A epidemiologist concludes that mortality risk depends on exposure to strong magnetic fields in the workplace, hence safer equipment must be bought. I II

If this type of error is made, who bears the cost of the error? (Circle one)
workers the employer

An epidemiologist concludes that mortality risk does not depend on exposure to strong magnetic fields in the workplace. I II

If this type of error is made, who bears the cost of the error? (Circle one)
the workers the employer

7. The larger the mammalian heart, the greater the tension (T) exerted by some pressure p on the myocardium having radius r and thickness h.

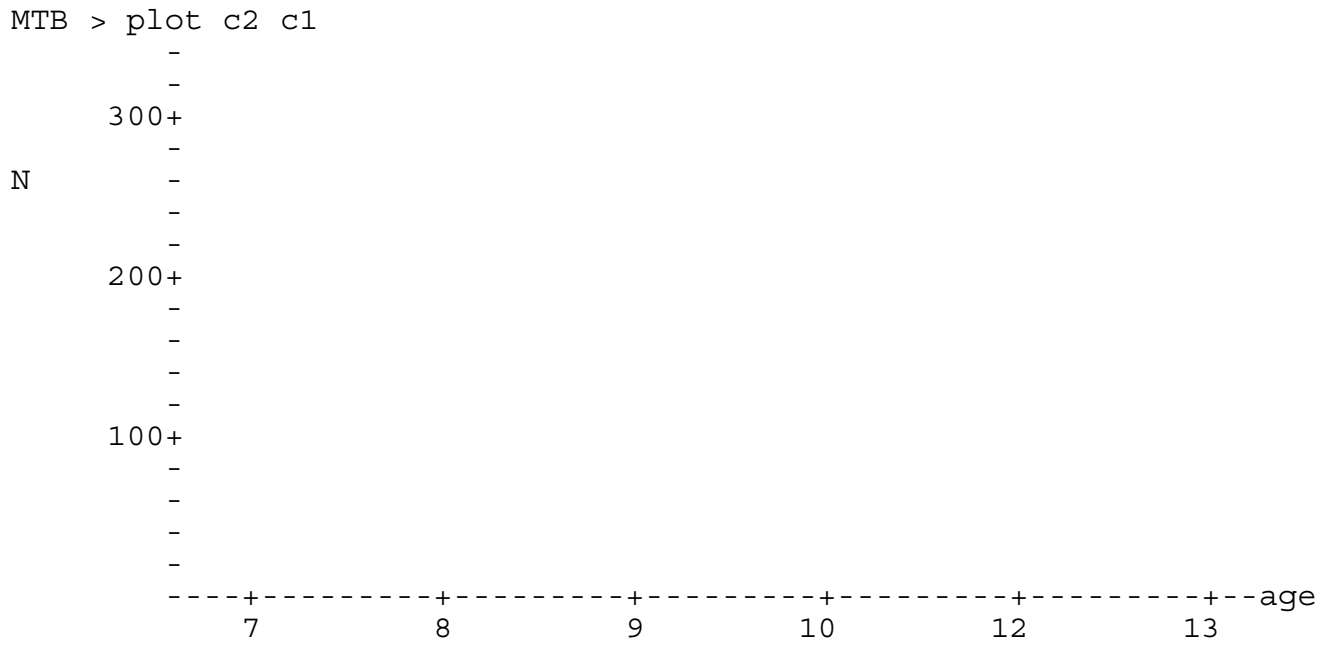
$$T = p \cdot r$$

If tension is held constant, and radius is reduced to one-third of its original value, by what factor do we expect pressure p to change ? 3 [1]

If pressure has units of $g^1\ cm^1\ sec^{-2}\ cm^{-2}$ and r has unit of cm.
What units does tension T have ? $g\ sec^{-2}$ [1]

M	L	T	
1	−3	0	Dimensions of mass concentration (kg cm^{-3})
1	0	−2	Dimensions of tension T [1]
1	−1	−2	Dimensions of pressure p [1]
0	1	0	Dimensions of radius r [1]

8a. The sign of a residual is defined as the sign (plus or minus) of (Data – Model)



Halibut catch (N = thousands of fish) in relation to age (a = years)

Draw a straight line relation showing decrease in halibut catch with increase in age. [1]
downward trending line, from left to right

Add 6 data points (at ages 8 through 13 years) consistent with the following pattern of residuals + + – – – + first 2 data points above line, next 3 below line, last above [1]

8b. For the straight line you have drawn, estimate the slope of the line [1]
β_{age} = circa (0–300)/(13–7) ≈ -50, or closer to zero

What units does β_{age} have ? fish/year [1]

For the data you have drawn, make a rough estimate of the mean of the 6 values of catch mean(N) = β_0 = circa 150-200 [1]

8c. In words state an H_A/H_o pair for testing whether catch decreases with age. [2]

H_0: Catch does not vary with age
H_A: Catch varies with age

Express in symbolic notation an H_A/H_o pair for testing whether catch decreases with age. [2]
A convenient statistic to measure the pattern is β_{age}, the slope of the line.

H_0: $\beta_{age} = 0$ or H_0: $\beta_{age} \geq 0$

H_A: $\beta_{age} \neq 0$ H_A: $\beta_{age} < 0$